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Power Supply Adequacy in the 5th Power Plan

Power Committee Discussion

July 13, 2004

What is adequacy?

- Physical –

  Region assured that, in aggregate, load serving entities (LSE) have sufficient power resources to satisfy forecast future loads with acceptable risk of loss of load (does not include transmission or distribution)

- Economic –

  Region assured that….sufficient power resources to ensure acceptable risk of high costs

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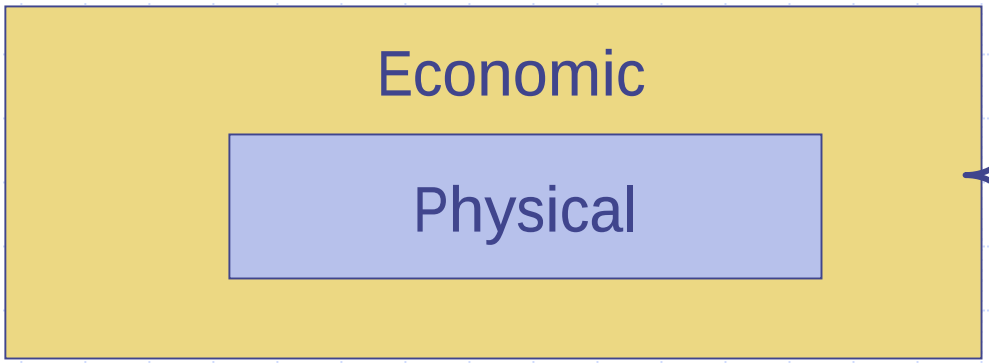
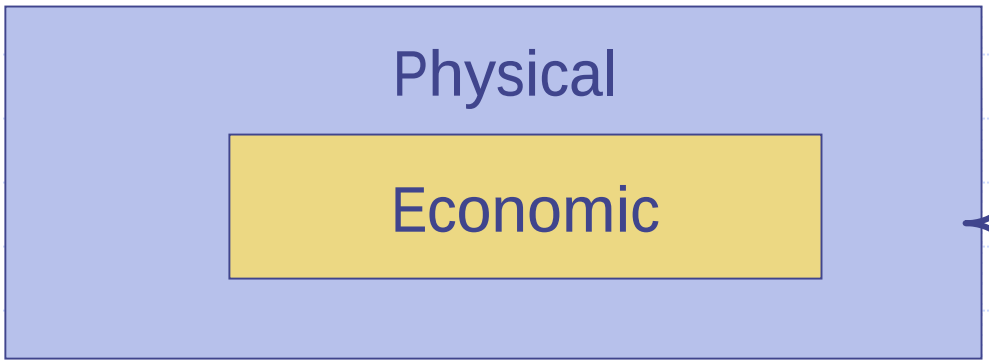
Physical vs Economic



Economic Risk dominated by market risk – additional resources dampen market risk more than they increase capital risk



Economic Risk dominated by capital risk – doing more than necessary to assure physical adequacy increases economic risk

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Historical perspective

Wally Gibson: Clarifies that critical water was only about what party was entitled to under the contract.

- Northwest originally an “electrical island”
  - Critical water planning part of PNCA -- firm power entitlement based on critical water
    - Less limiting than today -- Multi-year critical period, part of DSI load interruptible
  - Also in PNCA -- maintaining 5% LOLP entitled LSE to call on others for help without penalty if they got into trouble

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More history

- Construction of the inter-tie – NW no longer an island
  - Firm power still determined by critical water but... NW sold into Cal markets to offset capital costs during high oil and gas prices in 70s and early 80s
- Late ’80s -- Greater “leaning on the market”
  - Gas prices collapsed, Cal markets became attractive to buy from
- 2000-2001
  - Large critical water deficits
  - Lost the bet on market risk

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Future???

- Resources have less capital risk –
  - Smaller unit sizes,
  - Short lead times,
  - Lower cost of capital
  - Conservation and renewables always have some value
- Market????

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Physical Adequacy -- Two Metrics L/R Balance and LOLP

- Annual **L/R Balance**
  - Static tally of resources and loads.
  - Well understood and easily calculated.
- **LOLP** (loss of load probability)
  - Dynamic assessment of load serving capability.
  - More complicated to understand.
  - Simulation model is required.
  - Function of native resources AND available imports.

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Monte Carlo Simulation Program (for LOLP calculation)

Detailed NW Hydro Simulation

Hourly Economic Dispatch

Inter-regional Transmission Capacity (but not forced outages)

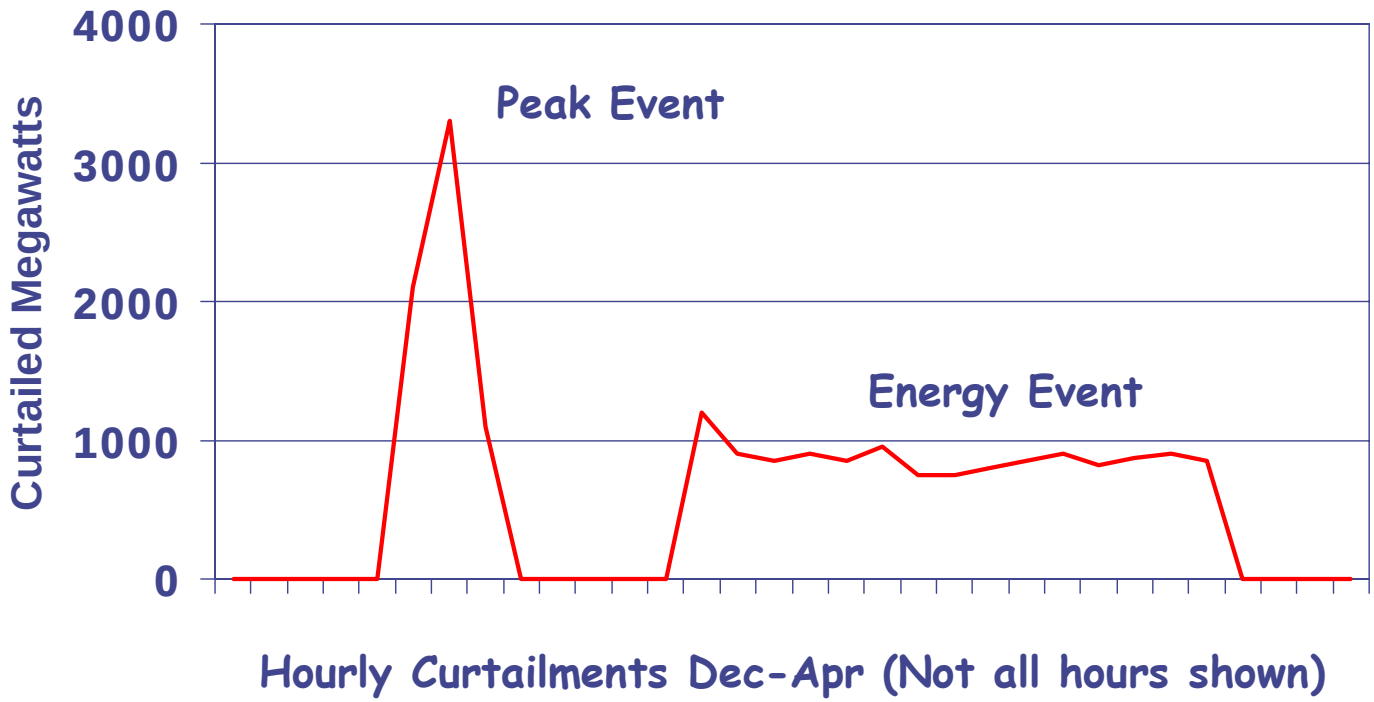
Random Variables:

- Water Conditions
- Temperature/Loads
- Thermal Resource Forced Outage

www.nwcouncil.org/genesys

Sample Curtailment Events

(Peaking problems and energy shortages)



Each event has a peak and duration.

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Monte Carlo Simulation Illustration Only

Game	Hydro Year	Temp Dev	Thermal Loss	Curt (mw-d)	Bad (?)
1	1929	-3	Beaver Out	2,400	Yes
2	1945	+2	None	0	No
3	1950	-1	Fredonia Out	500	No
300	1938	+1	None	0	No

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Loss of Load Probability

Number of games with bad outcomes	15
Total number of games	300

LOLP = 15/300 = 5%

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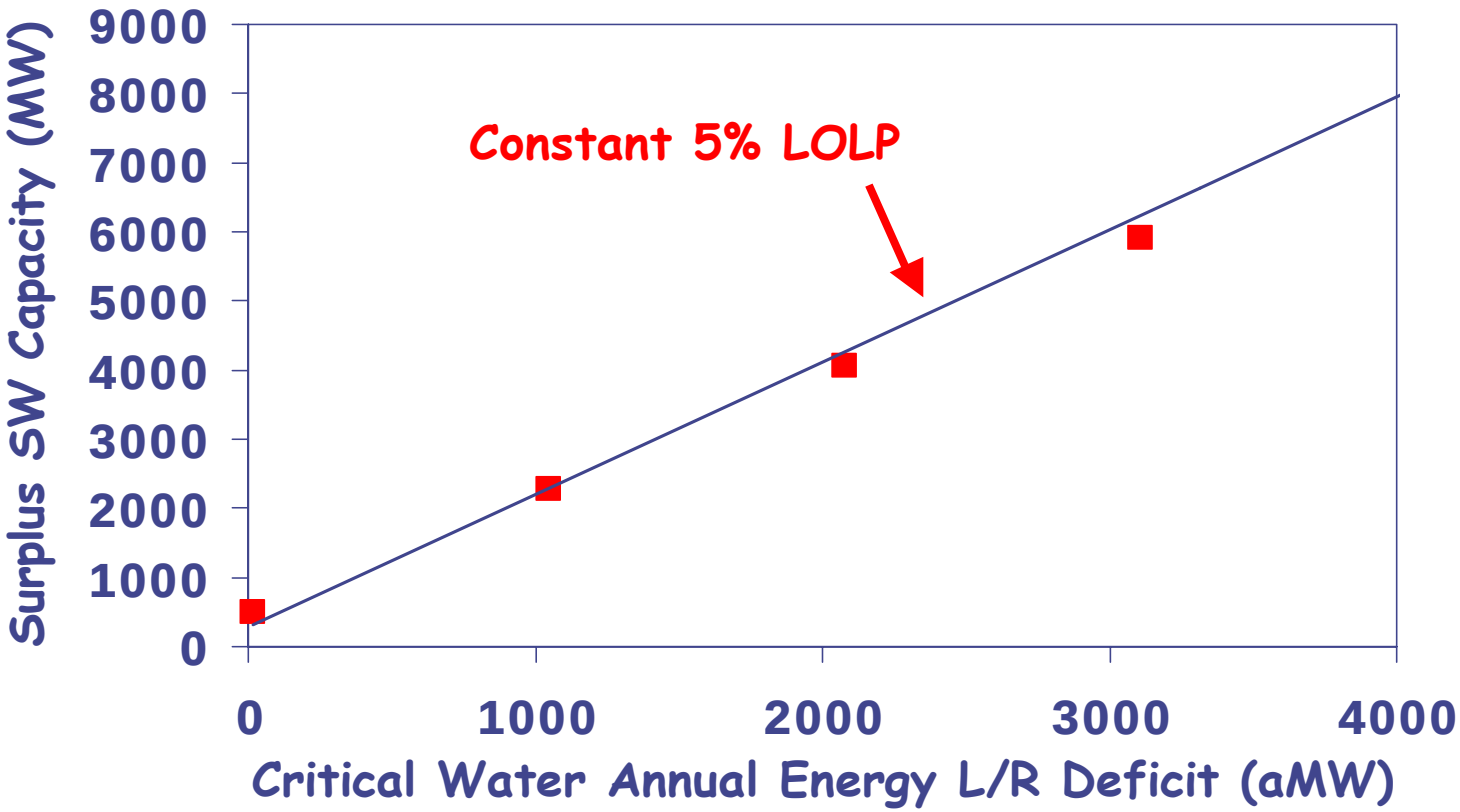
SW Surplus Capacity Needed for a 5% LOLP as a function of L/R Balance



Cost doesn't enter into consideration

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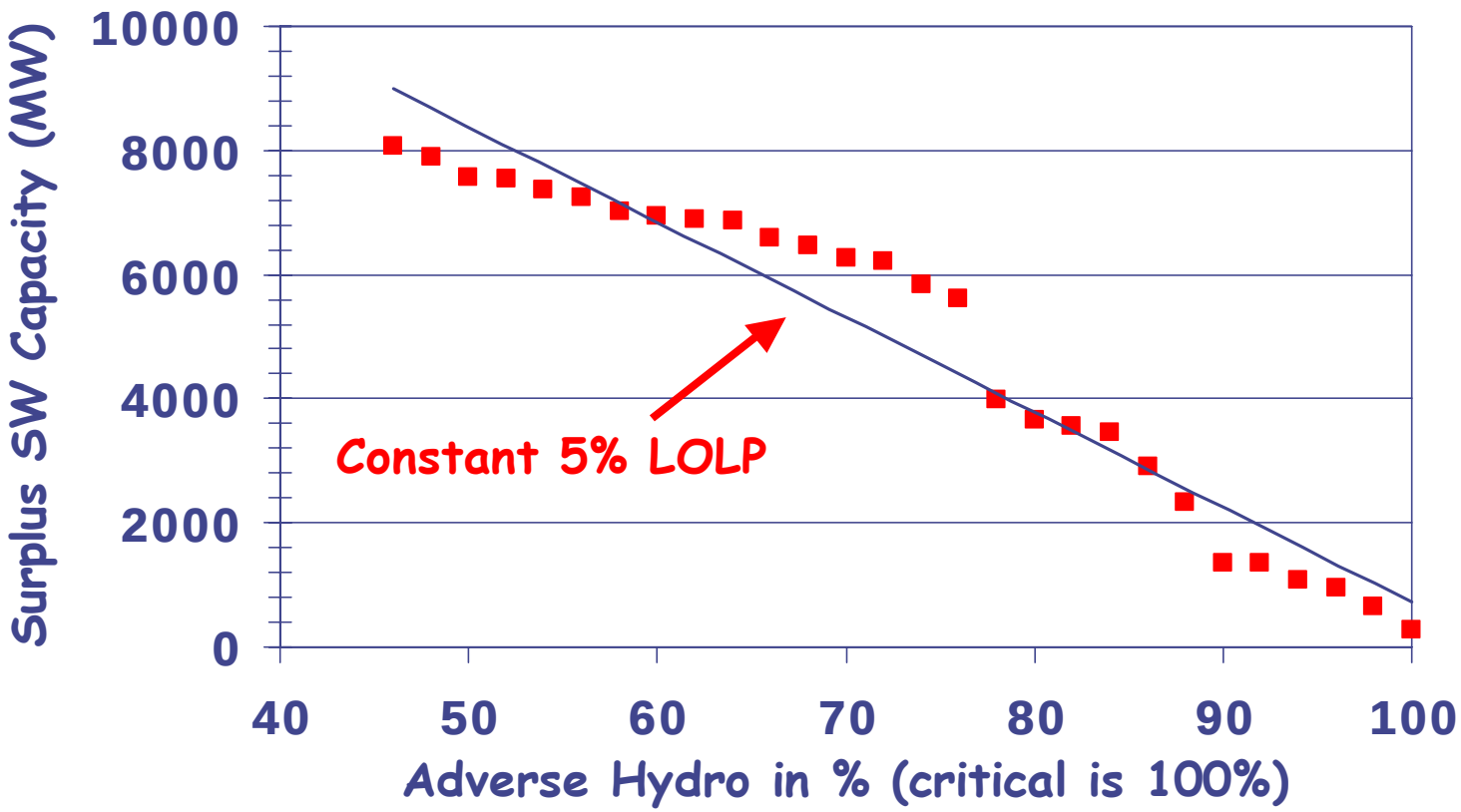
SW Surplus Capacity Needed for a 5% LOLP as a function of Adverse Hydro



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Portfolio analysis -- “Economic Adequacy”

- Portfolio model seeks resource *plans* (type, quantity, timing of resources) that minimize cost for a given level of risk
  - If insufficient resources – purchase from the market – market highly variable across futures
  - If being “resource thin” lowers cost and risk – so be it
  - If additional resources available reduces cost and risk – ditto
- So far – plans call for more resources than required for physical adequacy
  - A function of your assessment of futures – gas and electricity prices, loads

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How does an adequacy "standard" get established

- Unless we isolate ourselves from rest of West (costly), need to develop a regional standard that...
  - Works for energy-limited system like ours
  - Fits in the context of the Western interconnection (rest of West capacity limited)

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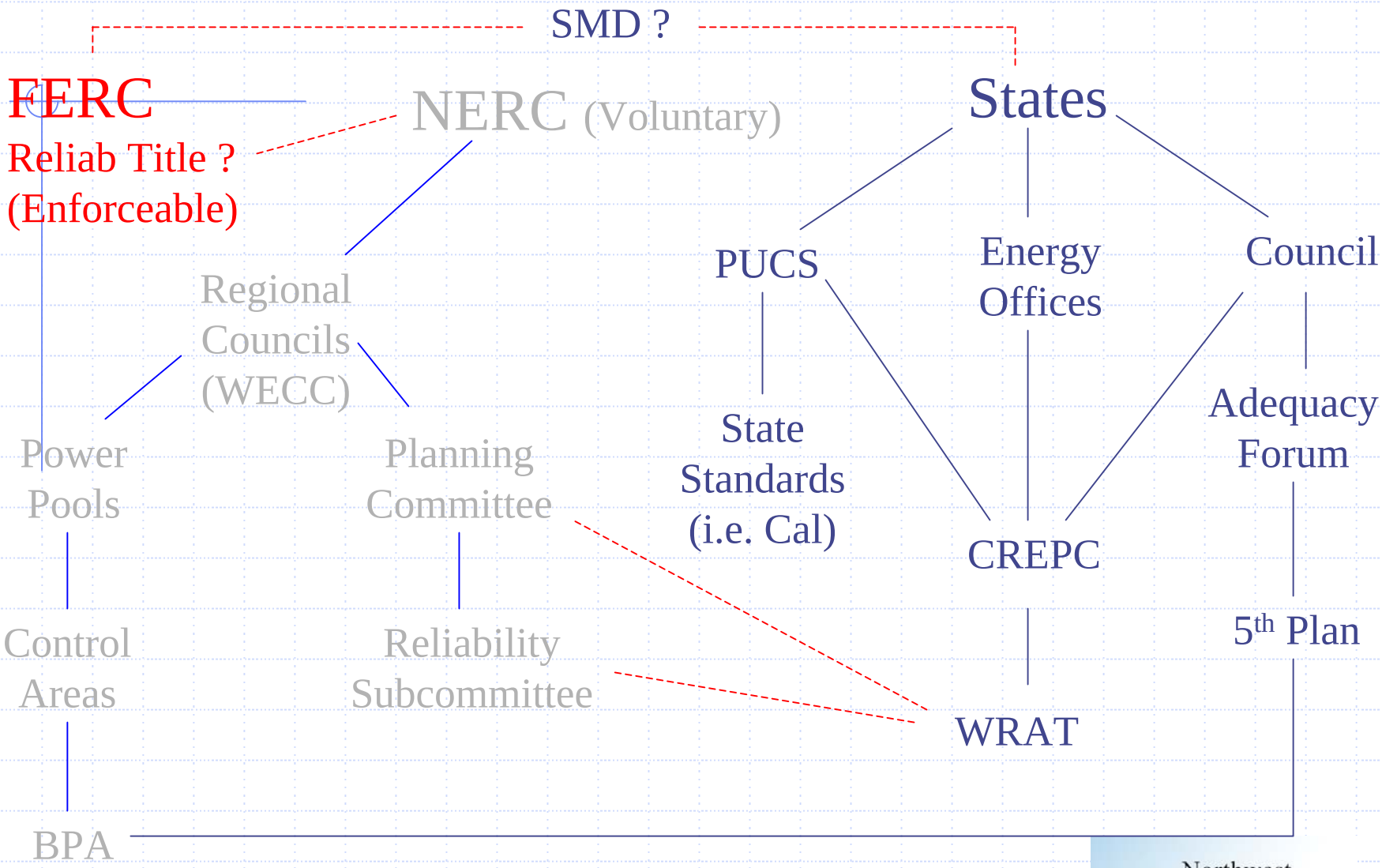
Institutional landscape for adequacy



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Options for a standard

- Data standards - Common definitions, transparency, etc
- Metrics - What do we look at in assessing adequacy? LOLP, Reserve margin? Hydro availability level?
- Voluntary targets - Where on the chosen metric(s) is the right place to be? LOLP = 5%, LOLP = 10%, etc?
- Enforceable standards - Rules to ensure LSEs have resources that meet the chosen targets
  - Authority to enforce???

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Load service levels at which standard could be applied

- WECC as a whole, without distinguishing any sub regional levels
  - View of the whole would necessarily be constrained by transmission availability
- WECC subregions, regions defined by other factors (e.g., the Northwest as defined by the Act, subregions defined by transmission constraints, states, etc.)
- Individual LSEs.

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Recommended approach

- Use draft plan to initiate dialog on physical vs economic adequacy
- Continue to work through WECC toward coordinated, voluntary, sub-interconnection (e.g. Northwest) PHYSICAL targets as a minimum
  - Clear targets, clear reporting
- Work with Bonneville, Commissions, individual LSEs on consideration of economic adequacy through IRP processes

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